Claims

What is claimed is:

1. A heat transfer roll on which sheet material is processed, comprising:

a first cylindrical shell;

a second cylindrical shell surrounding the first shell, and defining a cylindrical annular space therebetween, said space having an axial length and a periphery;

a first flow channel located in said annular space, extending along a first portion of the axial length and around the periphery of said annular space, the first flow channel having a first inlet and a first outlet; and

a second flow channel located in said annular space, extending along a second portion of the axial length and around the periphery of said annular space, the second flow channel having a second inlet and a second outlet.

2. The roll of claim 1, wherein the first flow channel further comprises:

a first seal having a cylindrical spiral path along the first portion of the length and around the periphery of said space from the first inlet to the first outlet, and the first seal extending between the outer shell and inner shell for sealing against fluid flow past the first seal.

3. The roll of claim 1, wherein the second flow channel further comprises:

a second seal having a circular path around the periphery of the annular space, and extending between the

outer shell and inner shell for sealing against fluid flow past the second seal;

a third seal being spaced axially from the second seal, directed in a circular path around the periphery, and extending between the outer shell and inner shell for sealing against fluid flow past the third seal; and

a transverse seal passing between the second inlet and second outlet, the transverse seal extending between the outer shell and inner shell for closing fluid flow between the second inlet and second outlet except by a circular path passing substantially around the periphery of the annular space of the second flow channel.

4. The roll of claim 1, wherein the first flow channel further comprises a first seal located in said space, the first seal being directed in a cylindrical spiral path along the first portion of the length and around the periphery from the first inlet to the first outlet, and the first seal extending between the outer shell and inner shell for sealing against fluid flow past the first seal; and

the second flow channel further comprising:

a second seal having a circular path around the periphery of the annular space, and extending between the outer shell and inner shell for sealing against fluid flow past the second seal;

a third seal being spaced axially from the second seal, directed in a circular path around the periphery, and extending between the outer shell and inner shell for sealing against fluid flow past the third seal; and

a fourth seal passing between the second inlet and second outlet, the fourth seal extending between the outer

shell and inner shell for closing fluid flow between the second inlet and second outlet except by a circular path passing substantially around the periphery of the annular space of the second flow channel.

5. The roll of claim 3, further comprising:

a third flow channel located in said annular space and spaced axially from the first flow channel, the third flow channel extending along a third portion of the axial length and around the periphery of said annular space, the third flow channel having a third inlet hydraulically connected to the first outlet of the first flow channel, and the third flow channel having a third outlet.

6. The roll of claim 5, wherein the third flow channel further comprises:

a fifth seal having a cylindrical spiral path along the third portion of the length and around the periphery of said annular space from the third inlet to the third outlet, and the fifth seal extending between the outer shell and inner shell for sealing against fluid flow past the fifth seal.

7. The roll of claim 6, wherein the first inlet has a union to connect to a first source of fluid.

8. The roll of claim 7, wherein the second inlet has a union to connect to a second source of fluid.

9. A heat transfer roll on which molten sheet material is processed, the roll comprising:

first and second journals supporting the roll for rotation about an axis;

a first end plate supported on, and secured to the first journal;

a second end plate spaced axially from the first end plate, supported on, and secured to the second journal;

a first cylindrical shell and a second cylindrical shell surrounding the first shell, the second cylindrical shell being secured to a radially outer periphery of the first and second end plates, the first and second cylindrical shells forming a closed cylindrical annular space between the first end plate and second end plate, and said annular space having an axial length and periphery;

a first flow channel located in said annular space, extending along a first portion of the axial length and around the periphery of said space, the first flow channel having a first inlet and a first outlet;

a first fluid path for carrying fluid to the first inlet;

a second flow channel located in said annular space, extending along a second portion of the axial length and around the periphery of said space, and the second flow channel having a second inlet and a second outlet; and

a second fluid path for carrying fluid to the second inlet.

10. The roll of claim 9, wherein the first flow channel further comprises:

a first seal having a cylindrical spiral path from the first inlet to the first outlet and being within the first portion of the periphery and axial length of said annular

space, and the first seal extending between the outer shell and inner shell for sealing against fluid flow past the first seal.

11. The roll of claim 10, wherein:

the first fluid path further comprises a first fluid passage formed in the first journal adapted for connection to a first fluid source, a first riser hydraulically connecting the first fluid passage and the first inlet, a second fluid passage formed in the second journal, and a second riser hydraulically connecting the second fluid passage and the first outlet; and

the second fluid path further comprises a third fluid passage formed in the first journal adapted for connection to a second fluid source, a third riser hydraulically connecting the third fluid passage and the second inlet, a fourth fluid passage formed in the second journal, and a fourth riser hydraulically connecting the fourth fluid passage and the second outlet.

12. The roll of claim 10, further comprising:

a third flow channel located in said space and spaced axially from the first flow channel, the third flow channel extending along a third portion of the axial length and around the periphery of said annular space, the third flow channel having a third inlet and a third outlet; and

a diverter axially extending along the length of said annular space, and the diverter being hydraulically connected between the first outlet and the third inlet.

13. The roll of claim 12, wherein the second flow channel further comprises:

a second seal located in said annular space, having a circular path around the periphery, and extending between the outer shell and inner shell for sealing against fluid flow past the second seal;

a third seal located in said annular space, spaced axially from the second seal, the third seal having a circular path around the periphery, and extending between the outer shell and inner shell for sealing against fluid flow past the third seal; and

fourth seal located in said space between the second inlet and the second outlet, extending between the outer shell and inner shell for closing fluid flow between the second inlet and second outlet except along the second flow channel passing substantially around the periphery of said annular space.

14. The roll of claim 13, wherein the third flow channel further comprises:

a fifth seal having a cylindrical spiral from the third inlet to the third outlet and being within the third portion of the periphery and the axial length of said annular space, and the fifth seal extending between the outer shell and inner shell for sealing against fluid flow past the fifth seal.

15. The roll of claim 14, wherein the first fluid path further comprises:

a first fluid passage formed in the first journal adapted for connection to a first fluid source;

a first riser hydraulically connecting the first fluid passage and the first inlet;

a second fluid passage formed in the second journal; and

a second riser hydraulically connecting the second fluid passage and the third outlet.

16. The roll of claim 15, wherein the second fluid path further comprises:

a third fluid passage formed in the first journal adapted for connection to a second fluid source;

a third riser hydraulically connecting the third fluid passage and the second inlet;

a fourth fluid passage formed in the second journal; and

a fourth riser hydraulically connecting the fourth fluid passage and the second outlet.

17. A heat transfer roll on which sheet material is processed, the roll comprising:

a first cylindrical shell having an axis;

a second cylindrical shell surrounding the first shell, and the second shell defining a cylindrical annular space with the first cylindrical shell, said space having an axial length and a periphery;

a first flow channel located in said annular space, extending along a first portion of the axial length and around the periphery of said space, the first flow channel having a first inlet and a first outlet, the first inlet is adapted for connection to a first source of fluid;

a second flow channel located in said annular space, extending along a second portion of the axial length of said annular space, the second portion being adjacent said first

portion, the second flow channel having a second inlet and a second outlet, the second inlet is adapted for connection to a second source of fluid; and

a third flow channel located in said annular space, the third flow channel extending along a third portion of the axial length of said annular space, the third portion being adjacent said second portion, the third flow channel having a third inlet and a third outlet, the third inlet is hydraulically connected to the first outlet.

18. The roll of claim 17, wherein the first flow channel is cylindrically spiral and directed angularly about the axis and axially along the axis.

19. The roll of claim 17, wherein the first and third flow channels each being cylindrically spiral and directed angularly about the axis and axially along the axis.

20. The roll of claim 17, wherein:

the first and third flow channels are each cylindrically spiral and directed angularly about the axis and axially along the axis; and

the second flow channel comprises a circular cylindrical channel located axially between the first and third flow channels.

21. A method for forming sheets of material having a cross-section with a width and a thickness, the thickness having a relatively thin area and a relatively thick area, the thin area extending across a first portion of the width,

and the thick area extending across a second portion of the width, the method comprising the steps of:

extruding molten material through a die having an orifice with a shape complementary to the cross-section of the sheet being formed;

placing the extruded molten sheet on a heat transfer roll having a surface exposed to a first flow channel and a second flow channel;

locating the sheet on the roll such that the lateral location of the thin area corresponds to the lateral location of the first flow channel, and such that the lateral location of the thick area corresponds to the lateral location of the second flow channel;

supplying fluid from a first fluid source to the first flow channel; and

supplying fluid from a second fluid source to the second flow channel.

22. The method of claim 21, further comprising the steps of:

directing fluid through the first flow channel in a cylindrical spiral path; and

directing fluid through the second flow channel in a circular cylindrical path.

23. The method of claim 21, further comprising the steps of:

continually passing fluid from the first flow channel and returning said fluid to the first fluid source; and

continually passing fluid from the second flow channel and returning said fluid to the second fluid source.

24. The method of claim 22, further comprising the steps of:

continually passing a first cooling fluid through the first flow channel; and

continually passing a second cooling fluid through the second flow channel.